Unit 4
Day 4
Section 8.4
The Binomial Theorem

BINOMIAL COEFFICIENT

For non-negative integers n and r , with $r \leq n$,
the symbol $\binom{n}{r}$ is defined as

$$\binom{n}{r} = \frac{n!}{r!(n-r)!}$$

Using the TI-30X to calculate the binomial coefficient we use the nCr feature.

$$\binom{10}{7} = \frac{10!}{7!3!} = \frac{10 \cdot \overset{3}{\cancel{9}} \cdot \overset{4}{\cancel{8}} \cdot \cancel{7 \cdot 6 \cdot 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1}}{\cancel{7 \cdot 6 \cdot 5 \cdot 4 \cdot 3 \cdot 2 \cdot 1} \cdot \cancel{3} \cdot \cancel{2} \cdot 1} = 120$$

USE YOUR CALCULATOR TO DO THE FOLLOWING:

$\boxed{10}$, $\boxed{\text{PRB}}$ $\boxed{\to}$, $\boxed{\text{nCr}}$ $\boxed{=}$ $\boxed{7}$ $\boxed{=}$ This should give you 120.

$${}_{10}C_7 = \frac{10!}{7!3!}$$

Evaluate.

1) $\frac{7!}{3!4!} = \frac{7\cdot\cancel{6}\cdot 5}{\cancel{3\cdot 2}\cdot 1} = 35$

2) $\binom{8}{3} = {}_8C_3 = \frac{8!}{3!5!} = \frac{8\cdot 7\cdot\cancel{6}}{\cancel{3\cdot 2}\cdot 1} = 56$

3) ${}_{100}C_2 = \frac{100!}{2!98!} = \frac{\overset{50}{\cancel{100}}\cdot 99}{\cancel{2}\cdot 1} = 4950$

BINOMIAL THEOREM

For any positive integer n and any complex numbers x and y ,

$$(x+y)^n = \sum_{r=0}^{n} \binom{n}{r} x^{n-r} y^r$$

Refer to p. 603 for Binomial Theorem

Write the binomial expansion for each expression.

4)

$$(p+q)^5 = \binom{5}{0}p^5 + \binom{5}{1}p^4q + \binom{5}{2}p^3q^2 + \binom{5}{3}p^2q^3 + \binom{5}{4}pq^4 + \binom{5}{5}q^5$$

$$= p^5 + 5p^4q + 10p^3q^2 + 10p^2q^3 + 5pq^4 + q^5$$

5)

$$(x-2y)^6 =$$

$$\binom{6}{0}x^6 + \binom{6}{1}x^5(-2y) + \binom{6}{2}x^4(-2y)^2 + \binom{6}{3}x^3(-2y)^3$$

$$+ \binom{6}{4}x^2(-2y)^4 + \binom{6}{5}x(-2y)^5 + \binom{6}{6}(-2y)^6$$

HOMEWORK

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